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RObust Header Compression (ROHC): Requirements and Assumptions for 0-byte IP/UDP/RTP Compression

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Abstract

This document contains requirements for the 0-byte IP/UDP/RTP (Internet Protocol/User Datagram Protocol/Real-Time Transport Protocol) header compression scheme to be developed by the Robust Header Compression (ROHC) Working Group. It also includes the basic assumptions for the typical link layers over which 0-byte compression may be implemented, and assumptions about its usage in general.

1. Introduction

The goal of the Robust Header Compression (ROHC) Working Group is to develop header compression schemes that perform well over links with high error rates and long link roundtrip times. The schemes must perform well for cellular links, using technologies such as WCDMA, EDGE, and CDMA-2000. However, the schemes should also be applicable to other future link technologies with high loss and long roundtrip times.

ROHC RTP has become a very efficient, robust and capable compression scheme, able to compress the IP/UDP/RTP headers down to a total size of only one octet. This makes ROHC RTP an excellent solution for future cellular environments with new air interfaces, such as WCDMA, making even speech services possible over IP with an insignificantly lower spectrum efficiency compared to existing circuit switched solutions.

However, all-IP cellular networks will also be built with already existing air interfaces such as GSM and IS-95, which are less flexible using radio bearers optimized for specific frame sizes matching the speech codecs used. This means that not a single octet of header can be added without switching to the next higher fixed packet size supported by the link, something which is obviously very costly. In the long term, this drawback should of course be eliminated with new, more flexible air interfaces, but in the short term it would be desirable if an efficiency comparable to the circuit switched case could also be achieved for already deployed speech codecs when used over the existing air interfaces. To achieve that, it must be possible to completely eliminate the headers for a majority of the packets during normal operation, and this is the purpose of 0-byte header compression. All functionality normally provided by the 1-octet header must then be provided by some other means, typically by utilizing functionality from the lower layer. It is important to remember that the purpose of 0-byte header compression is to provide optimal efficiency for applications matching the link layer characteristics, not efficiency in general.

As a starting point for these requirements, the well-established requirements base developed in the ROHC WG has been used. From that, the requirements have evolved through input from the 3GPP2 community and from discussions within the WG.

2. Assumptions for the Applicability of 0-byte RTP Header Compression

The purpose of 0-byte header compression is to provide optimal usage of certain links when the traffic pattern of a packet stream completely matches the characteristics of that link. There are no assumptions that only packet streams complying with that pattern will occur, but optimal efficiency cannot of course be provided when this is not the case.

To make 0-byte header compression feasible, it is assumed that lower layers can provide the necessary functionality needed to replace the 1-octet headers and fulfill the requirements defined in section 3. An example is the synchronized nature of most cellular links, which can provide sequencing and timing information and make packet loss detection possible.

3. Requirements on 0-byte RTP Header Compression

Since 0-byte header compression for ROHC IP/UDP/RTP is a variant of regular ROHC RTP compression [ROHC], these requirements are described as deltas to those defined in the regular RTP requirements [RTP-REQ]. For simplicity, this section is also separated into the same three subsections as the requirements in [RTP-REQ], where the first deals

with the impact of header compression on the rest of the Internet infrastructure, the second concerns the headers to be compressed, and the third covers efficiency and link technology related issues.

3.1. Impact on Internet Infrastructure

The meaning of header compression is in no way changed by the introduction of 0-byte header compression. No additional impact on the Internet infrastructure is thus allowed. The "Transparency" and "Ubiquity" requirements of [RTP-REQ, section 2.1] therefore also apply to 0-byte RTP compression without any modifications.

3.2. Supported Headers and Kinds of RTP Streams

The 0-byte RTP compression scheme in general imposes the same requirements on supported headers and RTP streams as regular ROHC RTP [RTP-REQ, section 2.2]. However, there are some aspects regarding the "Genericity" and IPSEC requirements that should be noted.

The "Genericity" requirement of [RTP-REQ] states that compression of headers of arbitrary RTP streams must be supported, and this is also true for the 0-byte compression scheme to the extent that it is not allowed to assume certain RTP behavior. However, as also stated in [RTP-REQ], this does not preclude optimizations for certain media types where the traffic pattern is known. For 0-byte RTP, this means that the scheme must be able to handle arbitrary RTP streams in order to fulfill the requirements of section 3.1. However, due to the typical characteristics of 0-byte compression, by requiring a traffic pattern that suits the link over which it is implemented to be able to compress down to 0-byte headers, it becomes optimized for applications with link-suited traffic patterns. For traffic that does not comply with the link properties, the scheme must automatically and immediately fall back to non-0-byte RTP compression and must not have any impact on the packet stream.

Regarding IPSEC, it should be noted that 0-byte compression cannot be achieved if parts of the original headers are encrypted or carry randomly changing fields. IPSEC and 0-byte RTP header compression therefore do not go well together. If IPSEC is used and prevents 0-byte compression, the scheme must fall back to a less efficient compression that can handle all present header fields. Of course, this applies not only to IPSEC but to all cases where headers cannot be compressed down to 0-byte.

3.3. Performance Issues

All the performance requirements of [RTP-REQ] also apply to 0-byte RTP header compression, with the following additions and exceptions:

- Performance/Spectral Efficiency: For packet streams with traffic patterns that match the characteristics of the link over which 0-byte header compression is implemented, the performance should be such that 0-byte header packets are generated during normal operation, most of the time. 0-byte headers would then replace most of the 1-octet headers used by regular ROHC RTP [ROHC].

  Justification: Spectrum efficiency is a primary goal. Studies have shown that for certain applications and link technologies, even a single octet of header may result in a significant decrease in spectrum efficiency, compared to existing circuit switched solutions.

- Header Compression Coexistence: The scheme must fit into the ROHC framework together with other ROHC profiles.

  Justification: Implementation simplicity is an important issue and the 0-byte RTP compression scheme should therefore have as much as possible in common with the regular IP/UDP/RTP profile.

- Unidirectional links: It is of less importance that the 0-byte header compression scheme be able to also work over unidirectional links.

  Justification: 0-byte header compression targets links that typically are bi-directional.

4. IANA Considerations

A protocol which meets these requirements, e.g., [LLA], will require the IANA to assign various numbers. This document by itself, however, does not require any IANA involvement.

5. Security Considerations

A protocol specified to meet these requirements, e.g., [LLA], may have a number of security aspects that need to be considered. This document by itself, however, does not add any security risks.

6. References

[RTP-REQ] Degermark, M., "Requirements for robust IP/UDP/RTP header compression", RFC 3096, July 2001.

[ROHC] Bormann, C., Burmeister, C., Degermark, M., Fukushima, H., Hannu, H., Jonsson, L-E., Hakenberg, R., Koren, T., Le, K., Liu, Z., Martensson, A., Miyazaki, A., Svanbro, K., Wiebke, T., Yoshimura, T. and H. Zheng, "Robust Header Compression (ROHC)", RFC 3095, July 2001.

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